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# THE CIAO: WEB PORTAL OF GEOGRAPHIC INFORMATION FOR WEST AFRICA

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**ABSTRACT :** This paper describes the “CIAO” project, based on an international initiative, part of the « Programme Régional de Conservation de la Zone Côtière et Marine d’Afrique de l’Ouest » or PRCM (Regional Program for the Conservation of the Coastal and Marine Area of West Africa). It leads to a web portal of information for the West African coastal zone. Investigations among the main producers of information have led to a first inventory of available geographical information. The information has been described in metadata files (ISO 19115) which have been collected into a catalogue based on a generic, multi-language client server application (MDWEB). The first version of CIAO gathers 236 metadata files that deliver information about geographical data on natural, human and regulatory parameters from local to regional levels and with various quality standards.

**Keywords (5) :** ICZM, GEOGRAPHICAL INFORMATION, METADATA, WEB PORTAL, WEST AFRICA

## INTRODUCTION

The West African coastal region is an area of strategic development. Important economic activities such as fisheries, tourism, transportation and the oil industry are concentrated on the littoral zone, resulting in a high level of degradation. In many cases, rapid development has been dictated by climactic and political crises, and it has taken place without any planning or cross-industry consultation. This has led to significant territorial changes which have resulted, in turn, in the degradation of the coastal area and its resources. It has also created conflicts of interests across the various industries involved.

Within this framework, the need for appropriate coastal management in West Africa is both obvious and urgent if the environment and its resources are to be preserved. In response to this need, the PRCM has been established. Its aim is to coordinate the efforts of institutions and individuals involved in conserving the coastal region of the following West African coastal countries: Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, Sierra Leone and Cape Verde (PRCM, 2003).

With this in mind, the “Bilan Prospectif,” anchor of the PRCM research’s activities (Quensièrre *et al.*, 2006), seeks to achieve a synthesis of the West African coastal zone by establishing a Geographical Information Base driven by a Geographical Information System (GIS).

The first phase of this synthesis is an inventory of geographical information on the studied zone. This document introduces the implementation of this phase<sup>1</sup> which resulted in a web-based catalogue of geographic information on West Africa.

## **METHOD**

The method is based on simultaneous steps: creating the information inventory and choosing the catalogue application.

### **Data inventory**

Interviews conducted between February and June 2006 with 38 West African public institutions and two French research organizations resulted in the first non-exhaustive inventory of available geographical information. Further to preliminary contacts, often based on recommendations from PRCM or Bilan Prospectif coordinators, interviews with the director or his or her representative and the person in charge of the database were held in the office of the institution. We preferred this kind of approach instead of using a standard survey sent by mail or email, so that we could guarantee answers and possibly consult existing databases (Guineberteau, 2005). During the interviews, geographical information were often presented, along with other related databases. We therefore decided to extend the inventory of geographical information to include databases that were formatted and managed coherently and that contained sufficient data to allow us to locate information and to consider integrating it later on within a geographic information base (*e.g.*, fishing statistics that include the names of landing sites, weather data structured by station, etc.). This first inventory was supplemented by research on the Web which lead us to include five free, downloadable world-wide databases available for research and educational purposes.

### **Selection of the catalogue application**

Four catalogue applications were tested in order to select the one best suited to the needs for the project (Table 1). For the study, the choice of the catalogue application is based on the following six criteria that are important so that end-users can make use of it: respect of the standard, free application, ease of use, possibility of archiving the resource, level of appropriation in West Africa, languages proposed by the catalogue application.

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<sup>1</sup> This joint study was completed within a cooperative and conventional framework between the UICN, the FIBA and the CNRS-University of Bretagne Occidentale (France).

Table 1. Comparison of the catalogue applications						
<b>Tool</b>	<b>Iso 19115</b>	<b>Open source / free</b>	<b>Ease of use</b>	<b>Resource archiving</b>	<b>Level of appropriation in West Africa</b>	<b>Language</b>
<b>ArcCatalog</b>	Yes	No	Related to GIS control	Related to the resource within the GIS	Very low	French English
<b>GeoNetwork</b>	Yes	Yes	?	?	No	English
<b>IdFix</b>	No	Internal tool within Geomer, testing phase	Yes	Yes	No	French
<b>MDweb</b>	Yes	Yes	Yes	Yes	Envisaged in the long term, for 28 institutes of research and government bodies of Cape Verde	French English Portuguese

In order to meet the needs of the catalogue of geographic information in West Africa, the comparison of the various tools led us to choose MDweb, which allows for the online management, consultation and diffusion of standardized metadata. Moreover, this choice also allows to capitalize the approach that Cape Verde has undertaken within the framework of the Sistema de informação Ambiental (SIA), or environmental information system.

The structure of the described metadata is based on ISO standard 19115. This standard recommends that a large number of data be captured, not all of which are pertinent for all types of resources. The MDweb solution allows for the construction of templates, kinds of filters applied to the standard, according to the needs of each type of resource. The templates can also contain additional elements that extend the standard. This kind of template is used as model to structure the metadata captured (Granouillac, 2004). Moreover in MDweb, numerous functionalities ensure that certain fields of the input forms are reduced, automated or defined. Among these is an XML import module that allows metadata coming from other catalogue applications, including ArcCatalog, to be imported.

### **Adaptation of MDweb**

The MDweb 1.4 version, developed by the Institute of Research and Development (IRD-France) and its partners, has been modified for CIAO to allow the development of a tailored catalogue which offers the possibility of online metadata file consultation, described resource archiving, and cataloguing. In particular, the consultation and cataloguing functions propose a cartographic interface that allows a geographical area to be defined about which the data files can be questioned or localized<sup>2</sup>.

<sup>2</sup> The cartographic interface is based on four layers of information (coastline, country of the PRCM countries, capitals, and network of PRCM-protected areas) in order to guarantee an easy access whatever the quality of the Internet connection. The data relating to the protected areas result from the World Database on Protected Areas (WPA) of the UNEP-WCMC and the WCPA consortium. The use of this information within the framework of the

## THE CIAO: MAIN FUNCTIONALITIES AND RESOURCES

The CIAO is based on six types of resources (templates)<sup>3</sup>: geographical information bases, relational databases, digital charts, vectors, rasters, spreadsheets. Geographical information bases and relational databases are classified as data collection. Other resources (vector and raster, numerical chart and sorter) are data sets (Roselt/OSS, 2004). Moreover, through the parent and daughter files, accessible *via* the cataloguing interface, the CIAO allows the possibility of creating connections between certain resources, as is the case, for example, between a geographical database and a vector to which it is attached. The “vector” and “raster” templates were completed in order to integrate the concepts of description, maintenance and conditions of use of the resource.

French metadata files, validated by the institutions that manage the data, are available at [www.prcmarine.org/ciao](http://www.prcmarine.org/ciao). The CIAO homepage leads to the SIA portal, allowing a consultation of the Cape Verde metadata.

### Functionalities

The CIAO offers three principal online functions: metadata file consultation, described resources archiving, and cataloguing.

To consult metadata, three types of search can be used: map searches, data-type searches, and multi-criteria search. Users can search with their own key words or the ones suggested by three thesaurus included within the CIAO. As a complement to the default GEMET<sup>4</sup> and AGROVOC<sup>5</sup> thesauruses offered by MDweb, the CIAO gives access to a list of specific key words related to the specific West African information gathered.

The CIAO can also be used as an archiving tool for the described resources. This function allows a physical hosting of the information (images, maps, vector layers, etc.) within the server, to ensure survivability. Downloading is controlled by the institution manager of the data, due to the private/public option suggested during the “hanging” of the resource within the metadata file. In its first version, the CIAO contains no resources; conventions will have to be established between the PRCM and the producers.

The choice of what type of resource to tag will give the user access to a form to capture the metadata. The cataloguing interface guides the user throughout the process. The cartographic interface is always available throughout cataloguing so that the batch of data can be easily located. Some of the cataloguing fields of the form are mandatory. They correspond to the core of ISO standard 19115, which consolidates the elements necessary to identify the resource and to obtain an appreciation of its contents. Online assistance is

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CIAO was approved by the UNEP-WCMC (<http://www.unep-wcmc.org/>) which is the manager and the conservator. The layer of information about the protected areas was supplemented by some polygons provided by the network of PRCM-protected areas. The other vector layers are extracted from the Vector Map Level 0 Vmap 0 (DIGITAL Chart of the World), Edition: 5, zone SOAMAFR (Africa and South America) of the NGA (National Geospatial Intelligence Agency), whose data are in the public domain.

<sup>3</sup> The resources of the type “chart paper” and “presentation” were not regarded as priority in this first phase. The gauges relating to these resources, proposed by defect in MDweb, were withdrawn from the current version of the CIAO

<sup>4</sup> GEMET: General European Multilingual Environmental Thesaurus, developed by the European Environment Agency, which contains approximately 5,000 words relating to the environment. <http://www.eionet.europa.eu/gemet>

<sup>5</sup> AGROVOC: multilingual thesaurus concerning agriculture, forestry, fishing, food and associated fields (like the environment) developed by FAO. [http://www.fao.org/aims/ag\\_intro.htm](http://www.fao.org/aims/ag_intro.htm)

accessible any time through the drop-down menus of each window. The home page also offers consultation assistance and step-by-step details of the consultation function.

## Resources

Interviews with the main producers of information involved in West Africa (public institutions, research organizations from the South and the North, etc.) have allowed us to draw up a first, non-exhaustive inventory of available geographical information. This information has generally been produced for several space scales and at different points in time, within a well defined framework established by the research programs and the development or conservation projects.

The first version of CIAO, online in early 2007 ([www.prcmarine.org/ciao](http://www.prcmarine.org/ciao)), includes 236 metadata files that provide information on different types of resources (geographical information bases, relational databases, digital charts, vectors, rasters, spreadsheets) representing (Figure 1) :

- three different areas: natural, human and regulatory;
- various levels of space scales: from local to regional; and
- variable quality standards: levels of precision, exhaustiveness, and timeliness.

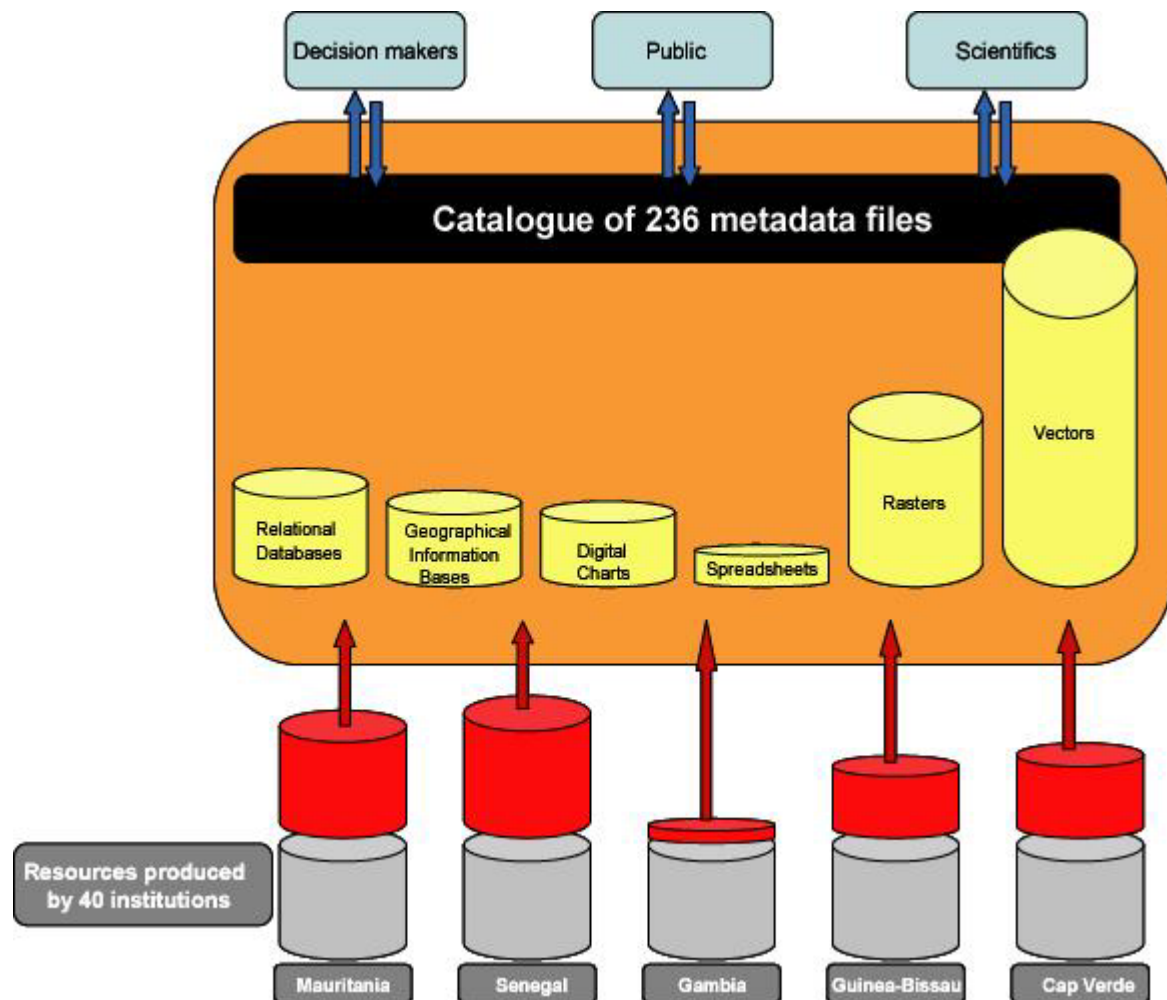


Figure 1: The CIAO structure and its resources

A first analysis of the CIAO resources gives a picture of the geographical information available within the surveyed institutions. Identified information relates mainly to the “natural” factor (40%) and “human” factor (39%). Information established at the territorial space scale (between 1/2 000 and 1/200 000) and the national space scale (between 1/200 000 and 1/500 000) are also most numerous.

Senegal seems to have more data than other countries. Most of the resources relate to the marine protected areas and other zones of ecological interest (53 resources). This finding is supported by the many studies carried out about national parks and reserves. Mauritania, which also has a great deal of data, shows a predominance of resources on a national scale (43), due to the number of studies of coastal zone management. Cape Verde, thanks to the inventory completed within the framework of the SIA project, is also well endowed with data, especially on the national scale (45). Guinea-Bissau mainly has data concerning the archipelago of Bijagos (38). Gambia, with only two geographical information bases on the national scale, shares with the other countries the data established across West Africa (13) and the world data bases in the public domain (21).

## **OUTLOOK**

The catalogue, currently located on a server based in France (University of Bretagne Occidentale) will be transferred during 2007 to a West African institution that will have the responsibility for managing the tool and its associated databases. PRCM will have to choose this institution by taking into account various technical, financial and human parameters to guarantee the continuity of the catalogue.

This first version of CIAO will grow gradually through the integration of new metadata files. The cataloguing interface allows the description of the resource *via* forms accessible to the users referred by the system administrator. Newly produced data or data that do not yet have metadata will thus be integrated, online, in the database of the CIAO catalogue.

If the interactive updating of the catalogue by the producers isn't operative, annual interviews could be planned, as they were for the original implementation, to meet the information producers and create new metadata files. This method would, on one hand, validate the metadata created online independently by the institution. On the other hand, it would be able to meet new data producers and integrate them into the CIAO user networks.

Other data inventories relating to the West African coastal zone are currently being developed: SIA in Cape Verde (Raulin, 2006), OLM in Mauritania (Pennober, Georis Creuseveau, 2005), Metalinus of C3EDOA/IRD Dakar, Canary Current Large Marine Ecosystem. Although some of these initiatives already collaborate with the CIAO with respect to tools or metadata, a harmonization of the existing catalogues could be planned in order to offer a unique global portal giving access to all information available on the study zone.

## **CONCLUSION**

Investigations among the main producers of information for West Africa (public institutions, research organizations from the South and the North, etc.) have allowed a first, non-exhaustive inventory of available geographical information to be drawn up.

Because of the wide range of data listed among the 40 institutions visited, the information has been described in standard metadata files (ISO 19115 format) to ensure its coherence

and comparability and that it can be shared by the stakeholders involved in the West African coastal zone. The metadata files have been collected into a Catalogue of Information for West Africa (CIAO), thanks to MDWEB, and they are accessible online, free of charge, at [www.prcmarine.org/ciao](http://www.prcmarine.org/ciao).

The first version of CIAO includes 236 metadata files that offer information on different types of resources representing different areas: natural, human and regulatory; various levels of space scales and variable quality standards. CIAO is a dynamic tool which will grow and gain from increased collaboration with all “coastal players”. Nevertheless, its operation depends now on the involvement of the African western organization that will take responsibility for hosting the CIAO and on the availability of an administrator who will ensure its management.

The main aim of this type of application is to increase the opportunities to gather and exchange dispersed and heterogeneous information. This is likely to support multi-sector and interdisciplinary approaches as well as increase the level of knowledge of local stakeholders and decision makers (Gourmelon *et al.*, 2006). The creation of the CIAO constitutes the first stage of the feasibility study of a Geographical Information System dedicated to the coastal zones of the PRCM.

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